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भाग 13 अनुरूप अवयव

Indian Standard

GRAPHICAL SYMBOLS FOR DIAGRAMS IN THE FIELD OF ELECTROTECHNOLOGY

PART 13 ANALOGUE ELEMENTS

UDC 681·335 : 003·62

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1992 **Price Group 5**

Basic Standards on Electronics and Telecommunication Sectional Committee, (LT 01)

NATIONAL FOREWORD

This Indian Standard (Part 13) which is identical with IEC Pub 617-13 (1978) 'Graphical symbols for diagrams — Part 13 : Analogue elements', issued by the International Electrotechnical Commission (IEC), was adopted by the Bureau of Indian Standards on the recommendation of the Basic Standards on Electronics and Telecommunication Sectional Committee (LT 01) and approval of the Electronics and Telecommunication Division Council.

The text of the IEC standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In the adopted standard, reference appears to an International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with the degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC Pub 27-1 1966	IS 3722 : 1983 Letter symbols and signs used in electrical technology	Technically equivalent

This standard is the thirteenth part of the series of Indian Standards on graphical symbols for diagrams. Other parts are:

Part 1 General information
Part 2 Symbol elements, qualifying symbols and other symbols having general application
Part 3 Conductors and connecting devices
Part 4 Passive components
Part 5 Semiconductor and electron tubes
Part 6 Production and conversion of electrical energy
Part 7 Switchgear, controlgear and protective devices
Part 8 Measuring instruments, lamps and signalling devices
Part 9 Telecommunications: switching and peripheral equipment
Part 10 Telecommunications: transmission
Part 11 Architectural and topographical installation plans and diagrams
Part 12 Binary logic elements

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

Indian Standard

GRAPHICAL SYMBOLS FOR DIAGRAMS IN THE FIELD OF ELECTROTECHNOLOGY

PART 13 ANALOGUE ELEMENTS

SECTION ONE — GENERAL

1. Scope and object

This standard contains graphical symbols for analogue elements in fields such as computation and control, to be used in diagrams.

The symbols and descriptions have been prepared with a view to electrical applications, but may also be applied to non-electrical systems (e.g. pneumatic, hydraulic or mechanical).

This standard is not necessarily applicable to programming applications using general purpose analogue computers equipped with a removable patch (programming) panel.

2. General rules

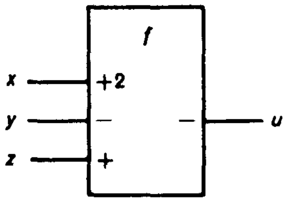
2.1 In many figures lower-case letters appear which are not part of the symbols and are added only for the purpose of identification of inputs and outputs as referenced in the description.

2.2 The symbols for sign indication are + and −. They are placed inside the outline of the symbol adjacent to each relevant input and output.

2.3 Weighting factors applied to the input signals are each indicated by a sign indicator in combination with a numerical value placed inside the outline of the symbol adjacent to the relevant input.
In this standard $w_1, w_2 \dots w_n$ which are understood to include the proper sign, will be used to denote the values of the weighting factors. When the weighting factor is +1 or −1, the number 1 may be omitted.

2.4 The symbol "*f*" is used to denote the function of an analogue element. "*f*" may be replaced by a symbol or a graph denoting the actual function.

2.5 *Example:*



Element in which:

$u = -f(2x, -y, z)$

SECTION TWO — QUALIFYING SYMBOLS FOR SIGNAL IDENTIFICATION

The symbols 13-02-01 and 13-02-02 shall be used only when it is necessary to distinguish between analogue and digital signals.

No.	Symbol	Description
13-02-01	∩	Identifier of analogue signals.
13-02-02	#	Identifier of digital signals. *Note.* — A time-sequenced number (*m*) of bits may be denoted by *m* #.

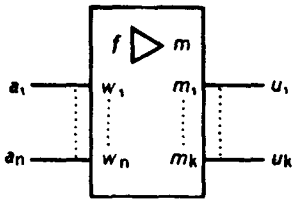
SECTION THREE — QUALIFYING SYMBOLS FOR AMPLIFIERS

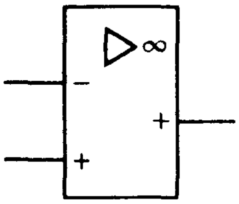
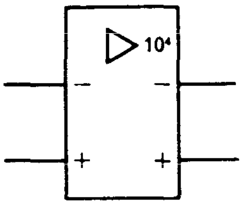
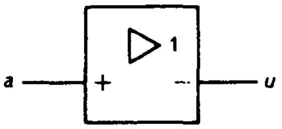
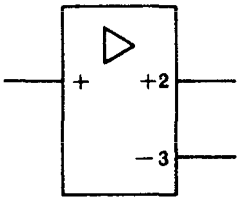
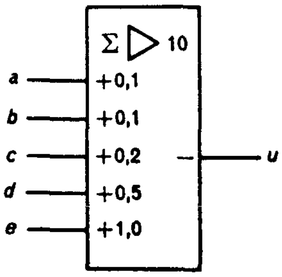
1) When an element performs a specific function in addition to amplification, "f" may be replaced by the appropriate qualifying symbol (see symbols 13-03-01 to 13-03-04) or may be omitted if no confusion can arise.

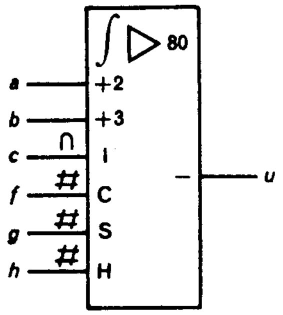
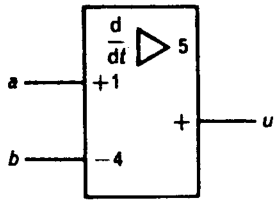
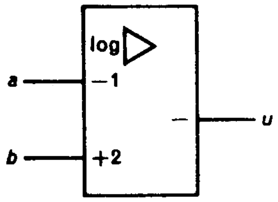
2) In particular cases, for example integrating amplifiers, special purpose inputs may be defined using symbols 13-03-05 to 13-03-11. If these symbols are not sufficient, controlling inputs should be labelled C_1, C_2 ... etc., and the effects of these should be defined in an associated table.

No.	Symbol	Description
13-03-01	$\sum$	Summing.
13-03-02	$\int$	Integrating.
13-03-03	$\frac{\mathrm{d}}{\mathrm{d}t}$	Differentiating.
13-03-04	log	Logarithmic.
13-03-05	F	Frequency compensation.
13-03-06	I	Initial condition, analogue value of integration.
13-03-07	C	Control: the defined 1-state allows integration.
13-03-08	H	Hold: the defined 1-state holds last value.
13-03-09	R	Reset: the defined 1-state resets the output condition to zero.
13-03-10	S	Set: the defined 1-state sets to initial condition.
13-03-11	U	Supply voltage (to be used if special requirements exist). Any necessary identification of the supply (numeric) or polarity (+ or −) follows the letter U.

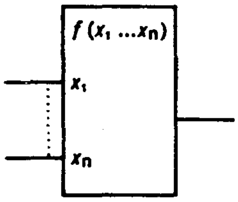
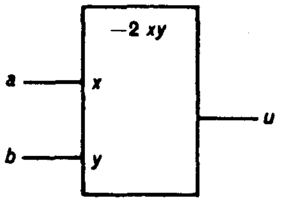
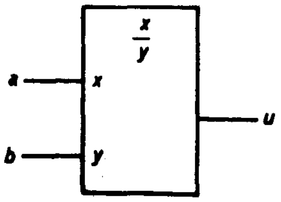
SECTION FOUR — AMPLIFIERS

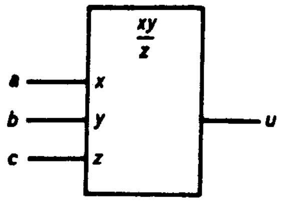
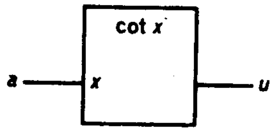
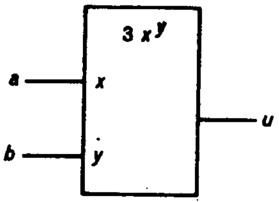
No.	Symbol	Description
13-04-01		Amplifier for analogue computation. General symbol. $w_1 \ldots w_n$ represent the signed values of the weighting factors. $m_1 \ldots m_k$ represent the signed values of the amplification factors. $u_1 = m \cdot m_1 \cdot f(w_1 \cdot a_1, w_2 \cdot a_2, \ldots, w_n \cdot a_n)$ The sign of the amplification factor is to be maintained at each of the outputs, except for those being digital in nature. When there is only one amplification factor for the whole element, or there is a common factor resulting from weighting factors and amplification factors, the "*m*" in the qualifying symbol may be replaced by the absolute value. When $m = 1$, the number "1" may be omitted. Signs should always be maintained at analogue outputs.

No.	Symbol	Description
		The use of the sign ∞ as an amplification factor is recommended where the nominal open loop gain is very high and the knowledge of its exact value is not of particular concern.
13-04-02		*Examples:* High gain differential amplifier (operational amplifier).
13-04-03		High gain amplifier with a nominal amplification of 10 000 and two complementary outputs.
13-04-04		Inverting amplifier with an amplification of 1. $u = -1 \cdot a$
13-04-05		Amplifier with two outputs, the upper, non inverting, has an amplification of 2, the lower, inverting output, has an amplification of 3.
13-04-06	 Σ 10 a b c d e +0,1 +0,1 +0,2 +0,5 +1,0 − u	Summing amplifier. $u = -10\,(0{,}1a + 0{,}1b + 0{,}2c + 0{,}5d + 1{,}0e)$ $= -(a + b + 2c + 5d + 10e)$

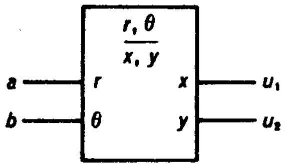
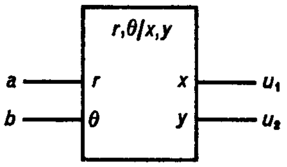
No.	Symbol	Description
13-04-07	 ∫ 80 a +2 b +3 c ∩ I f # C g # S h # H − u	**Integrating amplifier (integrator).** If $f = 1$, $g = 0$ and $h = 0$ then: $u = -80 \left[c_{(t = 0)} + \int_0^t (2a + 3b) \, \mathrm{d}t \right]$ *Note.* — The symbols for signal identification (∩ and #) may be omitted if no ambiguity arises.
13-04-08		Differentiating amplifier (differentiator). $u = 5 \frac{\mathrm{d}}{\mathrm{d}t} (a - 4b)$
13-04-09		Logarithmic amplifier. $u = -\log(-a + 2b)$

SECTION FIVE — FUNCTION GENERATORS

No.	Symbol	Description
13-05-01		Function generator, general symbol. x_1 ... x_n represent the arguments of the function and may each be replaced by an appropriate indication, provided that no ambiguity can arise. All weighting factors are assigned the value +1 and are therefore omitted. $f(x_1 \dots x_n)$ shall be replaced by an appropriate indication of, or reference to, the function (see e.g. IEC Publication 27-1: Letter Symbols to be Used in Electrical Technology. Part 1: General). *Note.* — The graphic "/" shall not be used for the indication of the division because of ambiguity with the symbols for the level converter and the code converter.
13-05-02		*Examples:* Multiplier with weighting factor of −2. $u = -2ab$
13-05-03		Divider. $u = \frac{a}{b}$

No.	Symbol	Description
13-05-04		Multiplier-divider. $u = \frac{ab}{c}$
13-05-05		Cotangent function. $u = \cot a$
13-05-06		Exponential function. $u = 3a^b$

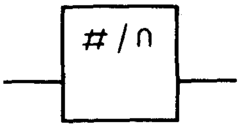
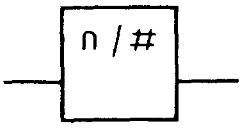
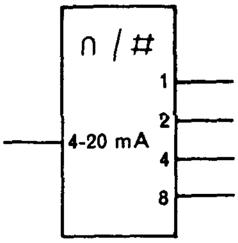
SECTION SIX — COORDINATE CONVERTERS

No.	Symbol	Description
13-06-01		Coordinate converter, polar to rectangular. $u_1 = a \cdot \cos b$ $u_2 = a \cdot \sin b$
13-06-02		Coordinate converter, rectangular to polar. $u_1 = \sqrt{a^2 + b^2}$ $u_2 = \arctan \frac{b}{a}$

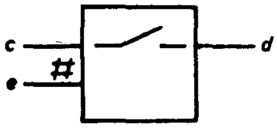
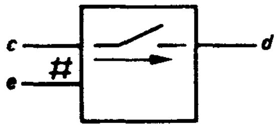
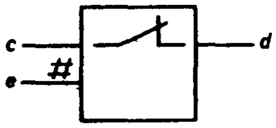
SECTION SEVEN — SIGNAL CONVERTERS

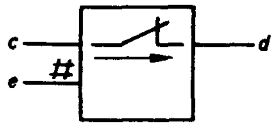
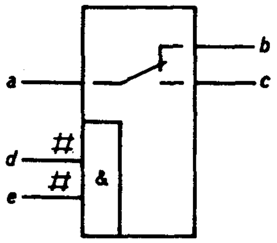
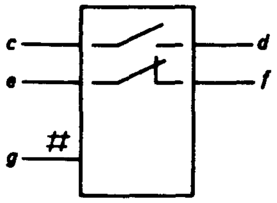
1. The indication of the specific relation between inputs and outputs may be shown inside the outline.

2. If the digital information is serial, the most significant bit is presented first unless otherwise indicated.

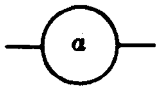
No.	Symbol	Description
13-07-01		Digital to analogue converter. General symbol.
13-07-02		Analogue to digital converter. General symbol.
13-07-03		Analogue to digital converter which converts the input range 4-20 mA into a 4-bit weighted binary code.

SECTION EIGHT — ELECTRONIC SWITCHES

No.	Symbol	Description
13-08-01		Bidirectional switch (make), general symbol. The analogue signal can pass in either direction between *c* and *d* as long as the digital input *e* stands at its defined 1-state. *Note.* — An arrow may be added to indicate an unidirectional switch (make).
13-08-02		*Example:* The analogue signal can pass only in the direction indicated by the arrow as long as the digital input *e* stands at its defined 1-state.
13-08-03		Bidirectional switch (break), general symbol. The analogue signal can pass in either direction between *c* and *d* as long as the digital input *e* stands at its defined 0-state. *Note.* — An arrow may be added to indicate an unidirectional switch (break).

No.	Symbol	Description
13-08-04		*Example:* The analogue signal can pass only in the direction indicated by the arrow as long as the digital input *e* stands at its defined 0-state.
13-08-05		Bidirectional transfer switch operated by the AND function of two digital inputs.
13-08-06		Two independent bidirectional switches (one make and one break), both operated by the same binary input.

SECTION NINE — COEFFICIENT SCALER

No.	Symbol	Description
13-09-01		Coefficient scaler. *Note.* — The value of the coefficient may be shown adjacent to and outside the outline of the symbol.

Printed at Dee Kay Printers, New Delhi, India

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Printwell Printers, Aligarh, India